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Coil Migration, Malposition, Stretching and Retrieval

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Summary

In this educational program for complicated coil placements, we report several cases of coil malposition, migration, and retrieval. We emphasize that a decrease in the expected one-to-one motion of the coil is the earliest sign of a possible imminent complication, and the over the core wire technique with a fixed-loop snare (Gooseneck microsnare) is a very effective potential solution for elongated coil retrieval.

Introduction

Since the early experience with detachable coils for interventional neuroradiology applications, coil related complications and failures have been noticed and discussed [1-9].

Microvascular devices, which have been designed to be intentionally delicate and soft in the cerebrovascular circulation, are by their nature also fragile and breakable.

The modern neuroangiography room should be equipped with state-of-art digital biplane angiography, in addition, the procedures should ordinarily be performed with continuous antegrade pressurized flush using heparinized saline. Using the interventional neuroradiology devices in this setting, which has been created to increase the safety and efficacy of the procedures, gentle and careful device manipulations are essential.

Here we present several cases of complicated intraprocedural coil placement during cerebral aneurysm treatment.

Diminishing One to One Motion

Normal one to one motion of a detachable coil during coil manipulation is ordinarily strong evidence of uneventful device manipulation. The diminishing of this one to one motion is perhaps one of the earliest alarms to the operator that suggest coil stacking and damage such as coil folding, thrombus formation, stack at the tight curve, and so on (figure 1). The operator must therefore be continuously monitoring the advancing coil during introduction with his eyes, and comparing the tactile sensation of coil advancement with his/her fingers to identify the appropriate degree of one to one coil motions on screen.

Case Presentation

Case 1: Post embolization GDC malposition (figure 2)

A 55-year-old female with ruptured VA-PICA aneurysm was treated with GDC- 10 soft coils through a FasTracker 10 catheter. After detaching the last coil with long detaching time, the catheter remained firmly attached to the electrically detached coil. The guidewire and the coil pusher would not advance through the

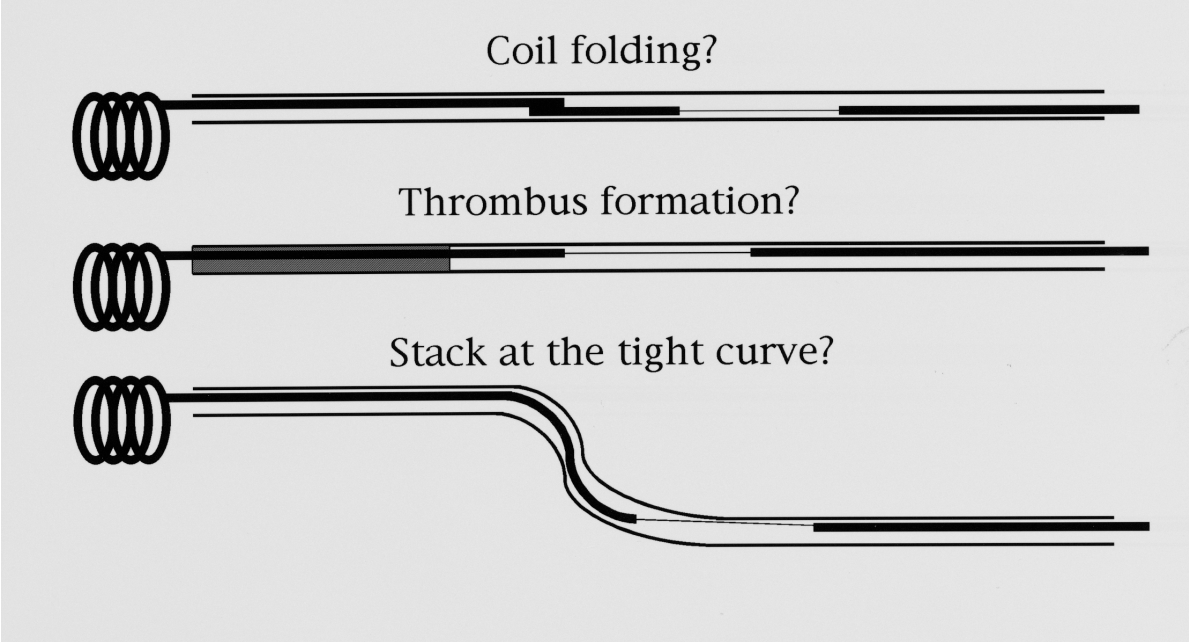

Figure 1 A decreasing or diminishing "one to one motion" during coil manipulation suggests several causes of coil troubles.

catheter tip. By slowly and gently withdrawing the catheter into the parent vessel, it was possible to confirm detachment and catheter retreival, with malposition of the last coil. In examining the microcatheter, coagulated thrombus was noticed in the tip of the catheter.

Case 2: Post embolization GDC motion (figure 3)

A 79-year-old female with a ruptured aneurysm arising from anterior communicating artery was treated with GDC-10 soft microcoils introduced through a FasTracker 18 MX. At the endpoint of the embolization, a loop of detached coil was noticed protruding into the anterior communicating artery. Full systemic heparinization was performed to protect from parent artery occlusion and distal embolisation, and a follow-up angiogram was performed four days following treatment, which at this point showed no change in coil position. The follow-up angiogram 2 months following embolization

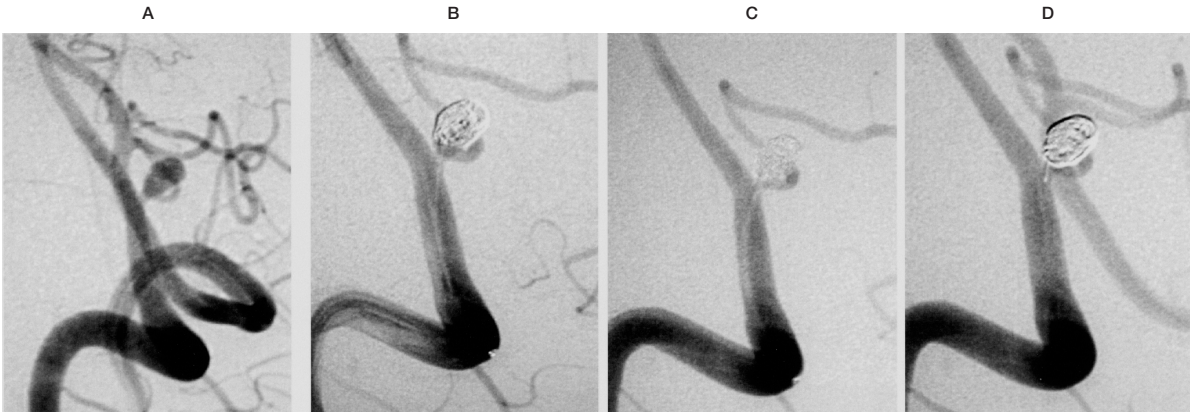

Figure 2 55 year-old female with ruptured VA-PICA aneurysm (A) was treated with GDC-10 soft (B). After detaching the last coil with almost 20 minutes, the catheter remained firmly attached to the electrically detached coil (C). The proximal portion of the last coil was noticed in the VA-PICA junction (D).

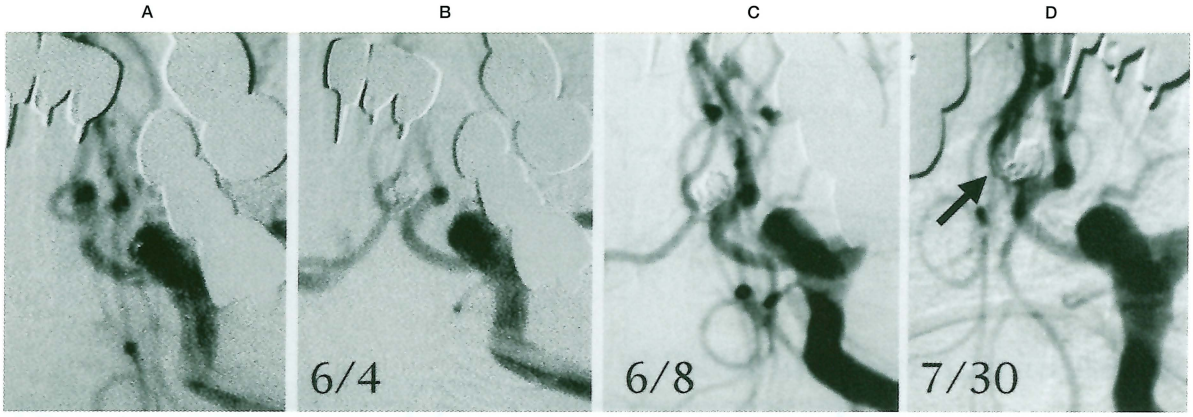

Figure 3 A 79 year-old female with a ruptured anterior communicating artery aneurysm (A) was treated with GDC-10 soft (B). At the endpoint of the embolization, a loop of coil was noticed protruding into the anterior communicating artery and it shows no change in coil position, four days later (C). However, the tail of the coil migration to the right A2 is noticed, 2 month later follow-up (D).

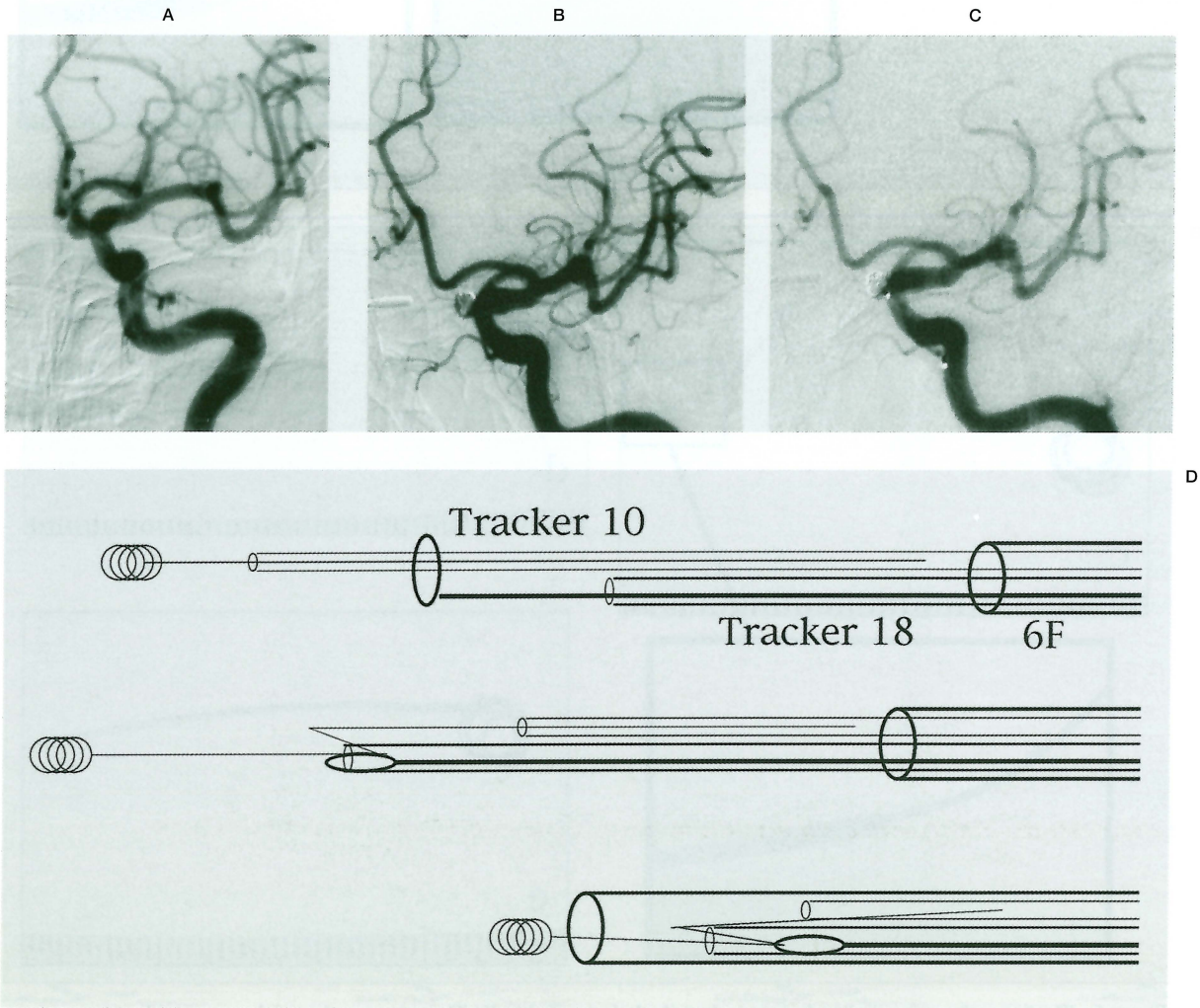

Figure 4 A 68 year-old female with an unruptured IC aneurysm (A) was treated with GDC-10 soft coils (B). During coil manipulation, the coil stacking and stretching were occurred (C). This coil was successfully and fully retrieved using a mono-rail technique with a gooseneck microsnare (D). The tracker 10 hub was cut and the microsnare was placed over the catheter. The tail of the coil was grasped by the snare and retrieved as a unit using the whole microvascular system.

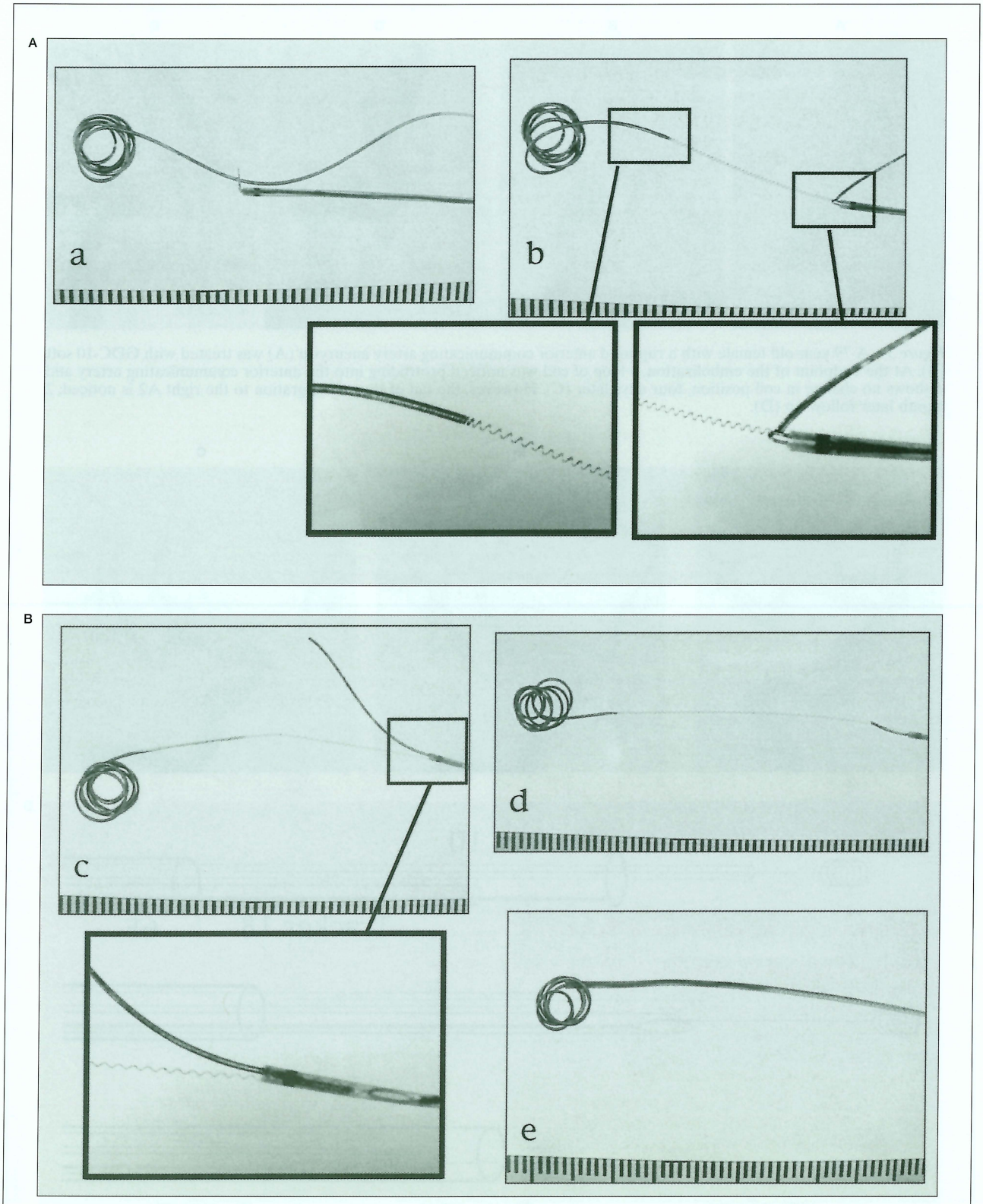

Figure 5 The "over the core wire" technique is described photographically. The engaging ring of the gooseneck snare engages the coil (A). A withdrawing by the snare causes the stretched primary coil broken and elongated into the core wire (B). The proximal end of the coil is pulling into the catheter with the elongated core wire (C). The catheter advances over the core wire and the primary coil is drawn into the catheter (D, E). After securing sufficient contact and therefore friction between the primary coil and the catheter to allow withdrawal, they are retrieve as a unit using the whole microvascular system.

demonstrated interval coil migration to the right A2 portion of the anterior cerebral artery, fortunately asymptomatic and uneventful without necessitating additional treatment.

Case 3: Coil stretching during coil manipulation (figure 4)

A 68 year-old female with an unruptured IC aneurysm was treated with GDC-10 soft coils through a FasTracker 10 microcatheter. During coil manipulation, a decrease in "one to one motion" of the coil suggested coil stacking and collapse. In spite of careful withdrawal of the partially inserted coil, stretching and coil elongation occurred. This coil was successfully and fully retrieved using a monorail technique with a gooseneck microsnare (figure 5).

Over the core wire technique for coil retrieval (figure 6)

The "over the core wire technique" for migrated or malpositioned detachable coils has been explained elsewhere and several cases successfully using this technique have already been reported [1]. Herein we describe this technique specifically and photographically using a gooseneck microsnare.

Discussion

In order to minimize the risk of complicated delivery while deploying and detaching detachable coils during interventional neuroradiology procedures, continuous pressurized flushing with heparinized saline is essential, as are gentle and careful manipulations with near continuous fluoroscopy. However, since the detachable microcoils are manufactured from a very small diameter platinum core wire which is tightly spiraled to form a primary coil measuring less than 1.5 mm in diameter it is not only extremely flexible and conformable, but is therefore also easily deformed, stretched, and suboptimal for withdrawal. When there is coil fatigue failure, the primary coil can therefore be stretched easily into the initially super thin formed core wire and can fracture.

We would like to emphasize that the diminishing of the feeling of "one to one motion" is likely the earliest alarm that suggests coil stacking and damage for the operator. In this situation, the operator must specifically heighten vigilance regarding imminent failure, and it is essential that the operator pay meticulous attention to coil stacking, stretching and fracture.

The "over the core wire" technique with gooseneck microsnare is an effective methods for microcoil retrieval [1]. A right-angled snare constructed of nickel-titanium (nitinol) cable is designed to grasp foreign bodies, and this can be especially helpful in removing the stretched or migrated coil [1-3]. Several techniques for microcoil retrieval had already been reported [4-9]. All techniques and devices will be useful and effective in suitable situations. However, the condition of the microcoil with regards to other devices and the relevant anatomical relationships will influence the success of each encounter. The neurointerventional radiologist must turn this knowledge to practical use when necessary.

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